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Male Mate-Locating Behavior in Two Australian Butterflies, *Anaphaeis java teutonia* (Fabricius) (Pieridae) and *Acraea andromacha andromacha* (Fabricius) (Nymphalidae)

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Abstract. Scramble competition for access to emerging virgin females that are moderately to highly aggregated characterizes male mating tactics in some populations of two Australian butterflies, *Anaphaeis java teutonia* (Pierinae) and *Acraea andromacha andromacha* (Acraeinae).

Key Words: *Anaphaeis, Acraea,* mating strategy

Introduction

I present notes on the mating systems of two Australian butterflies, *Anaphaeis java teutonia* (Fabricius) and *Acraea andromacha andromacha* (Fabricius), as a contribution to the natural history of these species. The male mating tactics of neither butterfly has been previously described (Common & Waterhouse, 1982), although Hawkeswood (1991) reports commonly encountering mating pairs of *A. andromacha* on a larval foodplant, *Passiflora suberosa.*

Anaphaeis java teutonia

The mating behavior of this species was first observed on 23 and 25 July 1993 in Kalbarri National Park about 5 km south of Kalbarri, Western Australia. Several dozen males were flying in a shallow rocky gorge within a few hundred meters of the coastline. Much of the activity was centered around a single caustic bush (*Sarcostemma australe,* Asclepiadaceae). Certain stems of the shrub were lined with a total of 29 pupae and empty pupal cases of the butterfly.

At 1500 hrs on 23 July, 17 males and 3 females were flying around or were perched in or near the shrub, including two pairs in copula. Unmated males flew several meters out and back from the plant, some inspecting the mating pairs closely, others courting (unsuccessfully) a single, apparently freshly eclosed, female perched in the area. This female was not receptive; she elevated her abdomen, and spread and fluttered her wings in response to courtship attempts.

At 1000 hrs on 25 July, 8 males and 2 apparently recently eclosed but unpaired females were present in and around the shrub; later that day at 1330 hrs, 15 males and 5 females were found in or near this one plant, including four pairs in copula on stems of the caustic bush. All mating males seen on both days possessed extremely worn wings (Fig. 1). Two males had been captured and killed in a spider web in the caustic shrub.

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Fig. 1. A very worn male copulating with a freshly eclosed female of *Anaphaeis java* at a site within Kalbarri National Park, Western Australia.

On another caustic shrub in the same general area I found four pupal cases in close proximity to one another, with one fresh adult female perched in the plant and three flying males nearby.

This species was also observed on 14 September 1993 at Yampire Gorge, Karajini National Park, Western Australia. On this day at 0830 hrs, there were two copulating pairs in a dead, leafless shrub (which was not *S. australe*) less than a meter high. About 12 unmated males flew in and around the plant on whose dead stems were aggregated 106 pupae and opened pupal cases. As at the Kalbarri site, copulating pairs were approached by patrolling males, which courted them (Fig. 2).

Acraea andromacha andromacha

This species was observed on 22 and 23 September at Windjana Gorge National Park, Western Australia in a flat plain of shorter dry grass roughly 135 m x 35 m surrounded by a taller savannah (Fig. 3). The male butterflies were flying low over the grasses in which were scattered numerous last instar larvae and pupae suspended from dried grass stalks. Over two mornings, records were made of the substrate on which 20 mating pairs were perched; 17 (85%) were found on a stem next to a cast pupal cuticle, indicating that males were mating primarily or exclusively with freshly emerged individuals (Fig. 4).

At 0900 on 23 September, the mean distance between one copulating pair and its nearest neighboring pair was 6.2 + 4.2 m for 11 different dyads. Thus, emerging, receptive females were present in moderately high density within the short grass patch.

Two solitary females that had recently eclosed were observed until contacted by patrolling males in 7 and 13 min respectively. The males courted the perched females in flight by buffeting their wings for a brief period, with copulation following.

In both cases, I carefully separated the male from the female within one min of the onset of copulation, and then returned the female to her perch. Female A was not approached by a male until 40 min had elapsed. The female rejected his persistent courtship by twisting her abdomen away from his and by opening and closing her wings. However, female A was seen mating 2 hr after her first copulation was experimentally terminated.

Female B was courted six times (presumably by different males) in the first 30 min after she was separated from her first partner; she rejected all six suitors but was seen coupled with a male 60 min later.

Searching males also courted copulating pairs (n = 3 records) as well as freshly eclosed males (n = 3) and even a pupa (n = 1), in addition to the unreceptive, experimentally unpaired females.

Discussion

Males of both species were seen searching for and mating with recently eclosed females. Males of the pierine *Anaphaeis java* focused their search on

Fig. 2. Unmated males of *Anaphaeis java* courting a copulating female at Karajina National Park, Western Australia. Note the line of pupal cases below the adult butterflies.

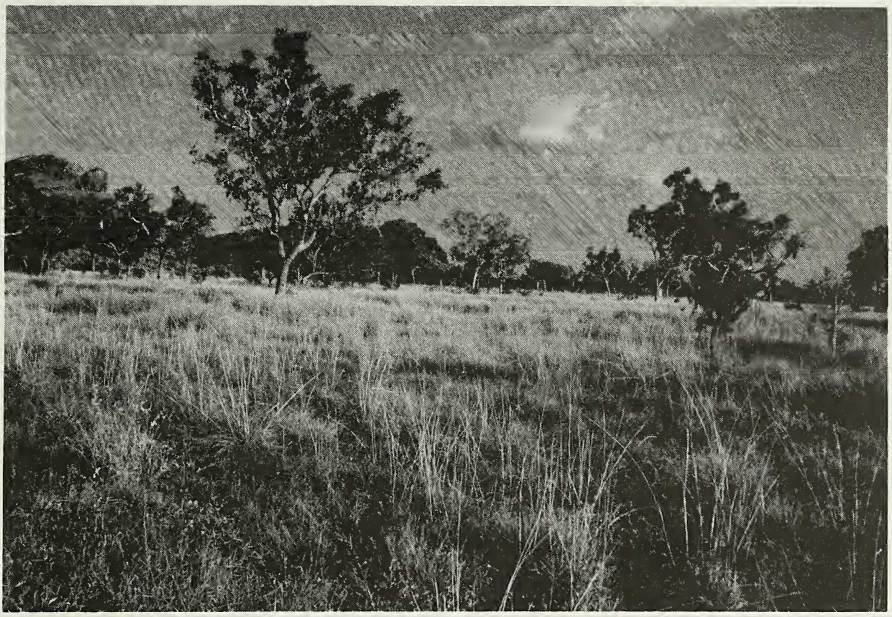

Fig. 3. The short grass plain that lies within taller grasses in the open savannah-eucalyptus woodland at Windjana National Park, Western Australia.

Fig. 4. A pair of *Acraea andromacha* on a dried grass stem; the pupal case of the freshly eclosed female appears between the two butterflies.

plants where large numbers of pupae were clustered together. These plants were not the larval foodplant, which are caper trees, *Capparis* (Hay et al., 1993), but rather leafless shrubs with considerable open stem space on which to pupate.

Males of *Acraea andromacha* patrolled a region where eclosing females were more diffusely distributed than in *Anaphaeis java*. Nevertheless, the density of females was much greater in the short grass area than in the surrounding savannah. In this species, pupation and eclosion also took place on a substrate (dried grasses) other than the larval foodplant, which is reported to be *Passiflora* spp. (Hawkesworth, 1991).

Male behavior in both species is consistent with the expectation that males will focus their mate-searching at sites where eclosing females are relatively densely distributed (Rutwoski, 1991). As Rutowski (1991) points out, female butterflies typically become receptive as they eclose or soon thereafter, judging from the rarity with which virgin females are found in the field. The receptivity of freshly emerged females clearly applies to the two Australian species whose behavior is described here. Under these circumstances, sexual selection favors males that can locate places containing higher than average numbers of eclosing females. Pupae are densely clustered in *Anaphaeis java* and moderately aggregated in *Acraea andromacha*, a fairly unusual phenomenon in butterflies that may be a defensive phenomenon linked to distastefulness in these species. In any event, the existence of pupal clusters concentrates freshly emerged females in small areas, enabling males to search economically for mates in these places.

Males are also predicted to time their mate-locating behavior to coincide with the periods when female eclosion is most likely to occur. The abundance of patrolling males of *Acraea andromacha* in the early morning at Windjana is consistent with the report that most males in a laboratory population emerged in the very early morning, with females following a little later (Hawkesworth, 1991).

Although territorial behavior has been reported for many butterflies (reviewed in Rutowski, 1991), neither species observed here exhibited territoriality. The limited duration of my observations means, however, that I cannot rule out the possibility that some males defended pupae that were on the verge of eclosing, as has been seen in a few butterflies (Bellinger, 1954; Elgar & Pierce, 1988). However, males that found females of *Acraea andromacha* that had been experimentally separated from their partners early in copulation did not remain with them. Moreover, the dominant mode of behavior for both Australian species clearly was nonaggressive patrolling. The relatively large number of individuals searching for mates within a small area, particularly in the case of *Anaphaeis java*, may have contributed to this outcome, inasmuch as the costs of repelling intruders from an area even a meter or two square would probably have been substantial.

The importance of finding freshly-eclosed females before rival males almost certainly favors patrolling flight over perch and waiting. Under some conditions, males of both species clearly engage in scramble competition for

access to eclosing females. Whether males have alternative mate-locating tactics remains to be documented, although observations of *Acraea andromacha* males at hilltops (Rutowski, pers. obs.) strongly suggest that they do.

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